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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/516,335	05/31/2005	Miles J. Padgett	620-349	3054
23117 7590 08/01/2007 NIXON & VANDERHYE, PC 901 NORTH GLEBE ROAD, 11TH FLOOR ARLINGTON, VA 22203			EXAMINER ROJAS, OMAR R	
			ART UNIT 2874	PAPER NUMBER
			MAIL DATE 08/01/2007	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/516,335

Applicant(s)

PADGETT ET AL.

Examiner

Omar Rojas

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2874

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 64-79 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 73-75 is/are allowed.
- 6) ☐ Claim(s) 64-70 and 76-78 is/are rejected.
- 7) ☒ Claim(s) 71, 72 and 79 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 November 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 11/30/2004.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☒ Other: Detailed Action.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

2. The listing of references in the Search Report is not considered to be an information disclosure statement (IDS) complying with 37 CFR 1.98. 37 CFR 1.98(a)(2) requires a legible copy of: (1) each foreign patent; (2) each publication or that portion which caused it to be listed; (3) for each cited pending U.S. application, the application specification including claims, and any drawing of the application, or that portion of the application which caused it to be listed including any claims directed to that portion, unless the cited pending U.S. application is stored in the Image File Wrapper (IFW) system; and (4) all other information, or that portion which caused it to be listed. In addition, each IDS must include a list of all patents, publications, applications, or other information submitted for consideration by the Office (see 37 CFR 1.98(a)(1) and (b)), and MPEP § 609.04(a), subsection I. states, "the list ... must be submitted on a separate paper." Therefore, the non-patent references cited in the Search Report have not been considered. Applicant is advised that the date of submission of any item of information or any missing element(s) will be the date of submission for purposes of determining compliance with the requirements based on the time of filing the IDS, including all "statement" requirements of 37 CFR 1.97(e). See MPEP § 609.05(a).

Specification

3. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. **Claims 64-70 and 76-78 are rejected under 35 U.S.C. 102(b) as being anticipated by**

Observation of the rotational frequency shift for light with intrinsic and orbital angular momentum by J. Courtial et al. published in IQEC '98, Pages 139-140, May 1998

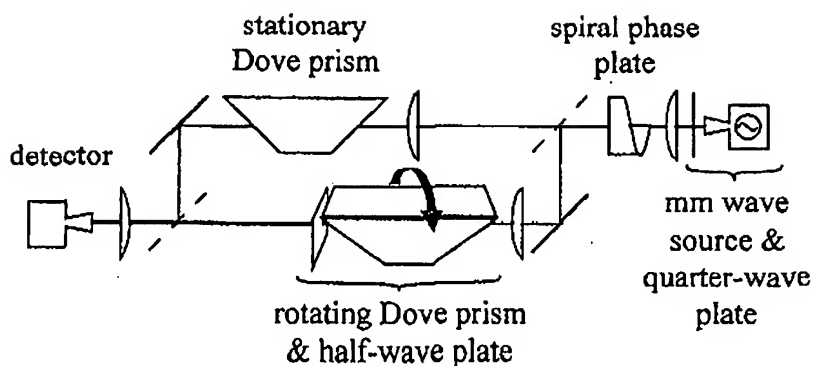
(hereinafter the "IQEC publication").

In re claims 64-66, 70, and 78, the IQEC publication discloses an electromagnetic device or system (Fig. 1) comprising:

an input (i.e., the light beam from the "mm wave source");

an output (i.e., the light received by the "detector");

and an optical interferometer comprising two beam splitters, two mirrors, and two Dove prisms wherein one of the Dove prisms is rotated. Fig. 1 of the IQEC publication is reproduced below.



QWJ5 Fig. 1. Experimental arrangement for the measurement of the rotational frequency shift associated with a rotating circularly polarized light beam with a helical phase front.

The optical interferometer disclosed by the IQEC publication inherently directs a photon from the input to a selected one of a plurality of outputs, the selection being dependent upon orbital angular momentum ("OAM") and spin angular momentum ("SAM") of the photon, because it has the same structure as the means for directing disclosed in the specification (i.e., it comprises two beam splitters, two mirrors, and two Dove prisms). Compare Figure 5 of the application's drawings with Fig. 1 of the IQEC publication.

In re claim 67, the rotating Dove prism disclosed by the IQEC publication is the same as the means for inducing a rotation or inversion as described in applicant's specification. Therefore, the device of the IQEC publication also inherently performs the function specified by claim 67.

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In re claims 68-69, the quarter-wave plate and the half-wave plate disclosed by the IQEC publication have the same structures as the means for rotation of the polarization state as described in applicant's specification. Therefore, the device of the IQEC publication also inherently performs the functions specified by claims 68-69.

In re claim 76, the device of the IQEC publication inherently provides the system with at least two possible output groups of output photons or states, the groups or states being selected by the device depending on an orbital angular momentum feature of an input photon because it has the same structure as the means for directing disclosed in the specification (i.e., two beam splitters, two mirrors, and two Dove prisms).

In re claim 77, as seen in Fig. 1, the system of the IQEC publication is an optical communication system.

Allowable Subject Matter

6. Claims 73-75 are allowed.

7. Claims 71, 72, and 79 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

8. The following is a statement of reasons for the indication of allowable subject matter: With respect to claims 71 and 72, the primary reason for allowance of the claims is the inclusion of the phased-array antenna adapted to detect angular momentum in or of the at least one electromagnetic signal. With respect to claims 73-75, the primary reason for allowance of the

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claims is the inclusion of a plurality of cascaded devices as specified by claim 73 wherein the devices are arranged with at least one output of one device communicating with another device.

With respect to claim 79, the primary reason for allowance of the claims is the inclusion of the multiplexing using angular momentum of electro-magnetic beams by generation and sensing using phase differences in arrays of antennae.

Conclusion

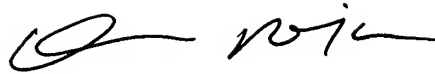
9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Patent No. US 7,173,711 B2 discloses an apparatus utilizing interference of optical beams with different Laguerre-Gaussian modes.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Omar Rojas whose telephone number is (571) 272-2357. The examiner can normally be reached on Monday-Friday (9:00PM-5:00PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rod Bovernick, can be reached on (571) 272-2344. The official facsimile number for regular and After Final communications is (571) 273-8300. The examiner's RightFAX number is (571) 273-2357.

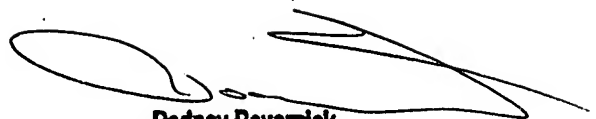
Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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Omar Rojas
Patent Examiner
Art Unit 2874

or
June 21, 2007



Rodney Bovernick
Supervisory Patent Examiner
Technology Center 2800